A STUDY OF THE SENSORY SYMPTOMS OF A CASE OF POTT'S DISEASE OF THE CERVICAL SPINE.*

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I have decided to present the following record because it well illustrates the difficulties of sensory studies. I had started to say some of the difficulties. But only those who are most used to making sensory examinations know best that they all present difficulties. In this case I am not offering new sensory problems nor attempting altogether new interpretations of old ones. On the contrary I have selected a case where the problem will readily appeal to those having only an ordinary knowledge of the anatomy, physiology and disease of the spinal cord. By what is in one sense a simple case I may gain the sympathy of a larger audience among those whom we wish to impress with the necessity of careful sensory work and its difficulties. In attempting to do this I shall apply to this case, in as simple manner as possible, the most recent data.

Dr. Henry Head, whose important contributions to sensory studies have gained very wide recognition, has recently published some observations, the result of a remarkable work both in its amount and its scientific character. I shall briefly sketch certain of his conclusions which are of assistance in a study of the kind of a case now before us. The sense of touch may only be distinctly tested by the lightest touch to the skin, which he makes by using with great care little whists of "cotton wool." If this care is not used "light touch" will be confused with pressure sensibility (deep pressure sensibility), which is separate and distinct and presided over by its own end organs and fibers, which latter travel with the motor nerves. This distinction can be made clinically, and when assured by the careful methods which he describes is at times of much value. One may feel the lightest touch possible to be made with the point of a blunt lead pencil, for example, and yet be minus light touch sensibility, so delicate is the pressure sensibility. This Head proved by destroying one kind of nerves and preserving the other kind of sensibility and vice versa.

In the same manner he proved that one kind of nerves and their end organs recognize only warm and cool temperatures, and another kind hot and cold ones; the first, for example, temperatures between 20C and 35C, (or about these) the latter only temperatures below 20C or above 50C (or about these). He shows that spacing sensibility is also distinct in kind and intimately connected with light touch. Although we may recognize by deep pressure sense when a certain part is touched, and locate this sensation with a good deal of accuracy, we cannot recognize with this kind of sensibility the two points of the dividers (esthesiometer). This is only accomplished by the "spacing sensibility" which may be absent in the presence of the pressure sense and vice versa. Head divides the sensibilities which we may test in the skin into three groups. In the first he places:

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Sensibility to light touch.
Sensibility for spacing. Epicritic Sensibility.
Sensibility for warm and cool.
(Between 20C and 45C).
In the second group he places:
Sensibility for pain.
Sensibility for hot and cold. Protopathic Sensibility.
(Below 20C and over 50C).
In the third group he places:
Sensibility to deep pressure.
(Located in muscles, tendons and joints).

When a nerve which has been severed has been sutured and begins to heal, the second group of sensibilities begin to return within seven or eight weeks and are rapidly restored. On the other hand the sensibilities represented in the first group do not show any sign of returning for 200 to 300 days and the full restoration of them is proportionately slow. He therefore named the second group "protopathic" sensibility; and the first one representing a much higher kind of sensibility, he named "epicritic." There is at least one advantage in these new terms, namely, they facilitate description. There are several reasons, however, why he has coined this new word "protopathic". As we have just stated the fibers which conduct this kind of sensibility are the first to heal, and when repair of them has taken place to a certain extent, trophic functions begin to return which were previously absent. For example in a complete anesthesia of all kinds of sensibility on the hand after severance of the ulnar, or another similar nerve trunk, a certain skin area is apt to be hard and dry and trophic ulcers apt to appear. With the return of the protopathic sensibility this portion of skin regains its moisture and the ulcers heal. This group of sensibilities is evidently closely associated with the vasomotor and trophic functions. In a region with disturbed protopathic sensibility there is also present what is generally spoken of as hyperesthesia *i. e.*, the prick of a pin or the contact of heat or cold causes a suddenly diffused, badly located sensation, with an irresitible tendency for the subject to wince *e. g.* to suddenly jerk the arm away when a protopathic area upon it is irritated.

He claims, and I believe proves, that what have been taken for different degrees of sensibility are actual differences in kind of sensibility. It will readily be seen that it is more important in almost any case to know the kinds of sensory disturbance than merely the degree of the same.

It is very easy to show the advantages of these distinctions in studying lesions of nerve trunks of various sizes. In this report I have attempted to show the advantage of keeping them in mind when studying a spinal case. In our case the onset was gradual, the pressure was very symmetrical, the subject in a hospital under constant observation, and an exceptional good one for this kind of examination.

Mrs. Chas. L. M., aged 25, married two years ago.; No important items in family history, nor in the personal or clinical history prior to the fall of 1904 (probably in the month of September). At that time she had a recurring slight pain in the back of the neck which was always (or nearly always) accompanied by a decided tingling paresthesia in the left arm. She describes it as coming in the outer side of the arm and very slightly in the fore-arm. About three months later, December, 1904, her baby was born and she was then much worse. In February, 1905, two months later, it was very bad. The pain was almost constant and she had severe paroxysms, during which the pain would radiate from the back of the neck out to the shoulder tips and up behind the ears and into the lower occiput. May 9th she went to Hot Springs, Ark., and remained seven weeks with no material benefit. During the summer months there was considerable relief, but the neck was always stiff and she was subject to frequent attacks during which the stiffness and helplessness and pain were much increased. In the fall months she steadily got worse. I first examined her December 21st, about fifteen months after the first appearance of pain and stiffness. For several weeks she had been getting very little sleep on account of the pain. The head was carried in a fixed position and she had to be very careful in her movements to prevent pain paroxysms. It was almost impossible to get a position on the pillows in bed that would relieve her. She indicated the spines of the 2d and 3 C. vertebræ as the centre or starting point of the pain. From there it radiated into the shoulder, especially the left and to the sides and back of neck and up to the lower occiput and back of the ears. She insisted that the pains had never crept high up on the back of the head. At times she had felt considerable pain shooting down the left arm as far as the middle of the fore-arm, but usually the sensation here had been a tingling paresthesia. Rotation of the head was quite limited, but better than extension and flexion, which were almost nil. Pressure over the spines was not tolerated and there were many sensitive places in the muscles of the back and sides of the neck, and a generally rigid state. No objective sensory symptoms were discovered at this time. The deep reflexes of the left arm seemed greater than those of the right. The knee jerks were plus and there was some ankle clonus on both sides. A week later she returned to the city and was put to bed at St. Luke's Hospital.

December 29, 1905, careful observations were begun.

As already stated the knee jerks and ankle jerks were exaggerated on both sides and there was a slight ankle clonus, but there was no Babinski nor Oppenheim. After sitting still for some time her legs were often somewhat stiff, and slightly spastic in starting to walk; but she could walk and ascend stairs without marked fatigue. There had been no bladder weakness at any time and she did not complain of her back at any point below the level of the shoulders. She complained of an extensive area of paresthesia, a numb feeling, not especially uncomfortable, on the anterior and external aspect of the right thigh. (Very much like a meralgia paræsthetica). Occasionally she experienced somewhat the same feeling in the toes and feet. She had a paresthesia similar to this in the upper extremities, felt more distinctly in the right arm and hand. She was never entirely free from this, but it was at times more pronounced. Of this she did not complain so much as she did of another sensation, namely, a feeling of arrestment and lack of precision in the movements of the hands, arms and shoulders. She found writing and sewing increasingly difficult and her hands and arms tired too soon, in holding a book, for example. This condition was more pronounced on the right side. And yet an actual inco-ordination could hardly be demonstrated. There were no localized atrophies. No groups of muscles seemed especially weak.

The sensory examinations included tactile, spacing, localizing, position, pressure, temperature and pain tests, all conducted with the precautions recently indicated by Head and others. Control tests were at times made on nurses. We were careful not to make the seances too long and to work only when the conditions were conducive to reliable results.

The patient is intelligent, well educated and of a temperament to make her an exceptionally good subject for this class of work. Between December 29 and January 8 we had examined the skin carefully on all portions of the body. On the left there was an area about the size of a silver dollar which embraced the edge of the trapezius half way between the acromion and the mastoid, where there was slight but evident hyperesthesia to pin pricks and to hot and cold. When this area was thus irritated to a certain extent she could not resist a jerking or shrugging of the shoulders. She could not here recognize warm and cool normally, only hot and cold, and light touch (cotton wool test) was slighty reduced, not lost in any portion of this small area. There was another spot not so large, on the anterior aspect of the deltoid over the head of the humerus where the conditions were similar. These two areas were so small and the deviations so slight that they could only have been established by the careful kind of an examination which we made.

In attempting to know the exact sensory state of an area of this kind it is necessary to have some tangible and conventional method of examination. I think it will readily be seen how Head's distinctions may be here applied, and the knowledge of them elucidates the description at once. But we may go farther and make certain deductions from them. We have here evidence that two classes of nerve fibers in the cord are involved. The epicritic fibers do not resist pressure as well as the protopathic. Here is an area which seems to show that both kinds of fibers have been only slightly disturbed, presumptively within the spinal canal, but so slight that it may not be taken into consideration except in a negative way in determining the condition of the cord.

These were the only objective sensory deviations present at this time. There were certain localities where there was at times a question of hyperesthesia; for example, at the bend of the elbow (*i. e.,* the plexor side), in drawing a needle upwards or downwards, as it reached this region the patient showed a tendency to flinch or slightly withdraw the arm.

But we found that this same condition obtained in normal subjects to such extent that we could not pronounce it abnormal in this case. It was the same on both sides.

The patient was kept in bed from the first, almost constantly. Within a few days the pain in the neck was rapidly diminishing, so that she was beginning to have restful nights. When she entered she could lie only with the left side of her head on the pillows and could rise from this position or change it only with much difficulty. She soon was able to sleep on the other side and turn from one side to the other with increasing freedom and to sleep all night with no medicine. She was also able to flex and extend the head with increasing freedom. Her general condition was very good in all respects. There was never any elevation of temperature. She had a good appetite and was in good condition. The function of the bladder was perfect. There was a constant constipation which was somewhat difficult to manage at times. She had all her life been of a constipated habit.

Between January 15th and 31st, routine examinations were made sufficiently to keep track of the sensory conditions, and no objective changes occurred. During this period she complained continually of a paresthesia in both hands, *e. g.*, she would say "things do not feel just natural," "I do not feel them distinctly" especially with the right hand. At the same time she could tell a penny from a dime with closed eyes and no objective defects could be established anywhere. By way of illustrating the manner in which the sensory tests were followed up we may cite a note made on January 18th. She was complaining of the paresthesia being most pronounced on the palmer surface of the thumb, index and second finger of the left hand. Tests were made as follows: light touch (cotton), position, location, pain, temperature, the latter made by spoon handles lifted from hot and cold, warm and cool water and dried before bringing them in contact with the skin. No objective changes were found.

During this period there is recorded a good deal of complaint of muscular startings in the right arm (brachial region) and right thigh. She also complained that the right foot and leg were "shaky" and "jerky" in walking (spasticity). There were at times between the 20th and 31st the suspicion of a Babinski and occasionally of an Oppenheim on this right side; none on the left side. The right knee jerk and ankle jerk seemed slightly greater than those of the left. February 6th we noticed for the first time that the spacing sense at the tips of the fingers on both hands, and especially the right index, was somewhat defective. Although very slight this obtundity seemed greater in the thumbs and the first two fingers than in other digits. There was no question that the distal phalanx of the right index was most involved. In all other respects sensation seemed objectively normal. The strength of the right arm was less than that of the left, *e. g.*, in lifting a good sized pitcher of water she could manage it better with the left than with the right hand. She could not at this time detect any differences in the feeling or in the strength of the lower extremities. On the 16th, however, she called our attention to the fact that the right leg was less reliable than the left and that there was a constantly increasing paresthesia in the thigh of this side. The knee jerks seemed equal. Sensory tests of all kinds were made at frequent intervals especially over this area on the front and external aspect of the thigh. We here estimated light touch 75% as good as on the opposite thigh. (This was with a most delicate cotton test.) There was only slight loss of spacing sense and temperature seemed equal to the opposite side. She noticed that the toes of this side were objectively and subjectively cooler than the opposite side, yet the temperature sensibility of them was so nearly that of the opposite side that it would be very difficult if at all possible to establish the fact of a difference.

Between the last of February and 10th of March we could notice a very gradual falling off of the sensory acuteness of the fingers, hands and fore-arms and to a less extent of the feet and legs. This obtundity was slightly more pronounced in the right hand, and in the index more than elsewhere. Light touch and spacing sensibility were the most affected in all localities on the hands at this time, and other kinds of sensibility so slightly so that delicate tests were necessary to make the conditions present evident. She could recognize almost everywhere the difference between 30C and 40C and sometimes even closer. The pain sense seemed perfectly acute.

By the 20th of March there was a great deal of paresthesia in the hands and feet (but no pain), and the paralysis was rapidly increasing and all kinds of sensory losses were evident. Although the sensory conditions still varied from day to day it was now evident that light touch and spacing sense were most affected and next to these position, and temperature and pain still less. There were small, variable but distinct areas of slight protopathic and epicritic disturbance all the way up the arms, especially on the right. The anesthesia of all kinds in the hands was more pronounced in the fingers and shaded off upwards, *i. e.*, somewhat of the glove character, being more pronounced on the radial sides, however. The hands were sweating a great deal and often cold and examinations were not easily made.

On the 26th of March she first experienced difficulty in emptying the bladder. Within a few days the catheter was constantly necessary. On April 1st the conditions were, briefly stated, as follows: R. upper exteremity; can flex and extend digits feebly except the index which she cannot extend, flexion and extension of wrist also very feeble. Pronation and supination complete but very feeble. Flexion of fore-arm almost lost, very feeble. Abduction and aduction of arm well preserved. The distribution of the paralysis was exactly the same in the opposite extremity but it was a shade less in all segments than that of the right.

The right foot, leg and thigh were all weaker than the respective segments of the left, and the right was more spastic. Babinski and Oppenheim reflexes could not be obtained on the right but both obtainable on the left. In other words they had disappeared from the right and appeared on the left. This was possibly due to the lowered sensibility of the right, or possibly to an increase spasticity which masked them.

At this time finer sensibility, *i. e.*, light touch, spacing and intermediate temperature sensibility were absent in the digits and the greater portions of both hands, but to a less extent, apparently, in the toes and feet. Position sense was lost in the digits, but not at the wrists until a little later date. Deep pressure, high and low temperature and pain sensibility were never altogether lost at any time, although much obtunded. A better idea of the conditions will be shown by the notes of several examinations made about this time, taking the right arm as an example: On the hypothenar margin an area two inches long and one and a half inch wide was hyperesthetic to heat, cold and pin pricks, sensitive to deep pressure, but insensible to finer sensation. Areas that were particularly hyperesthetic to pricks, heat and cold, were found just above the wrist, just below the elbow, about half way up the arm and just below the axilla on the ulnar side. Similar areas were found on the radial side, especially over the belly of the supinator longus and the belly of the deltoid. On both sides of the arm all the way up, areas were found where light touch was still well preserved. These areas were less difficult to outline than the protopathic ones but there were more of them over the size of a silver dollar. The same phenomena were present in all the other extremities and upon the trunk. The different kinds of areas were not disposed in the arms in a perfectly symmetrical manner but nearly enough so to show that they had a distinctly axial distribution, and were of spinal cord origin.

In this case the pressure was evidently from the front and so symmetrical and gradual that the different kinds of tracts in the cord all felt the effects of it and almost equally from before backwards. There were no symptoms pointing to focal lesions in either the anterior or posterior gray matter, hence no confusion in either motor or sensory signs from this source. There were no posterior root symptoms. The pains in the early history of the case although severe were not root pains. This is evident from the subsequent history. They were the kind of pains that have often been described as cervical neuralgia and were of peripheral origin.

There were no pupillary changes, and there were no respiratory symptoms that could be assigned to involvement of the phrenic nerves.

The uniform manner in which the distal portions of all extremities were most affected is explained by the well-known fact that the longest nerve fibers, or those which travel the greatest distance from a lesion, are most affected.

An X-ray examination made soon after the patient entered the hospital showed an absorption of the contiguous portions of the bodies of the 2d and 3d C. vertebræ and a tilting upwards of the spine of the 2d. Since the last report herein recorded there has been a gradual improvement, the patient having been kept under continuous extension.

Two years ago I reported to the American Neurological Association two cases of stiff neck with great pain, some paresthesia, with no paralysis but with deep jerks suspiciously increased. In these cases I found no objective sensory signs. The present case much resembled those cases when she first came under my observation and I began at once the application of these more recent tests, making a close personal study of it. Dr. Philip Newcomb kindly assisted me by making separate examinations for control and comparison.

I believe that after this kind of an examination we not only know better the conditions present but we can more definitely translate or express them. It is interesting to note the length of time the paralytic or motor signs and the subjective sensory symptoms preceeded the objective sensory signs, and it is a source of satisfaction to reveal this fact in a more precise way. The very gradual falling off of sensory function which occurred in this case is recorded in terms that are readily referred to for purposes of comparison and description.